

(12) UK Patent Application (19) GB (11) 2 316 957 (13) A

(43) Date of A Publication 11.03.1998

(21) Application No 9718918.7

(22) Date of Filing 05.09.1997

(30) Priority Data

(31) 159896	(32) 10.09.1996	(33) AT
196996	11.11.1996	
117797	09.07.1997	
135097	13.08.1997	

(51) INT CL⁶
D04H 18/00(52) UK CL (Edition P)
D1R RGFD(56) Documents Cited
GB 2310221 A GB 1358821 A US 4454637 A(58) Field of Search
UK CL (Edition O) D1R RGFD RGFX RGfZ
INT CL⁶ D04H 18/00
Online: WPI(71) Applicant(s)
Ernst Fehrer
Auf der Gugl 28, A-4020 Linz, Austria(72) Inventor(s)
Ernst Fehrer(74) Agent and/or Address for Service
F J Cleveland & Co
40-43 Chancery Lane, LONDON, WC2A 1JQ,
United Kingdom

(54) Device for needling a prebonded web

(57) There is described a device for needling a prebonded web (1), comprising at least one needle board reciprocatingly movable in stitching direction, and comprising a stitch base (2) between a feed roller and a discharge roller, which stitch base is located directly opposite the needle board and forms a web guide that is convex in direction of web movement. To create advantageous constructional conditions, it is proposed that the stitch base (2) should consist of blades (9) extending transverse to the direction of web movement and touching a continuously curved enveloping surface with their end faces (10) constituting a web support, between which blades there engage at least two needle rows (5) extending transverse to the direction of web movement. Elastomeric elements or brushes may be located between the blades (9) for penetration by the needles.

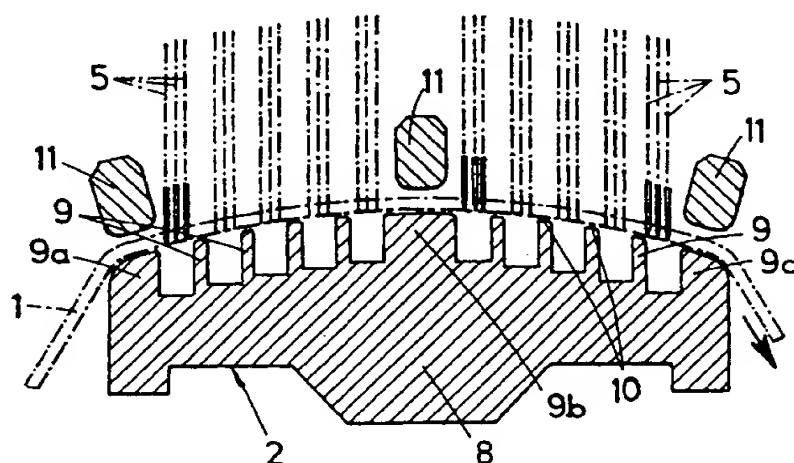
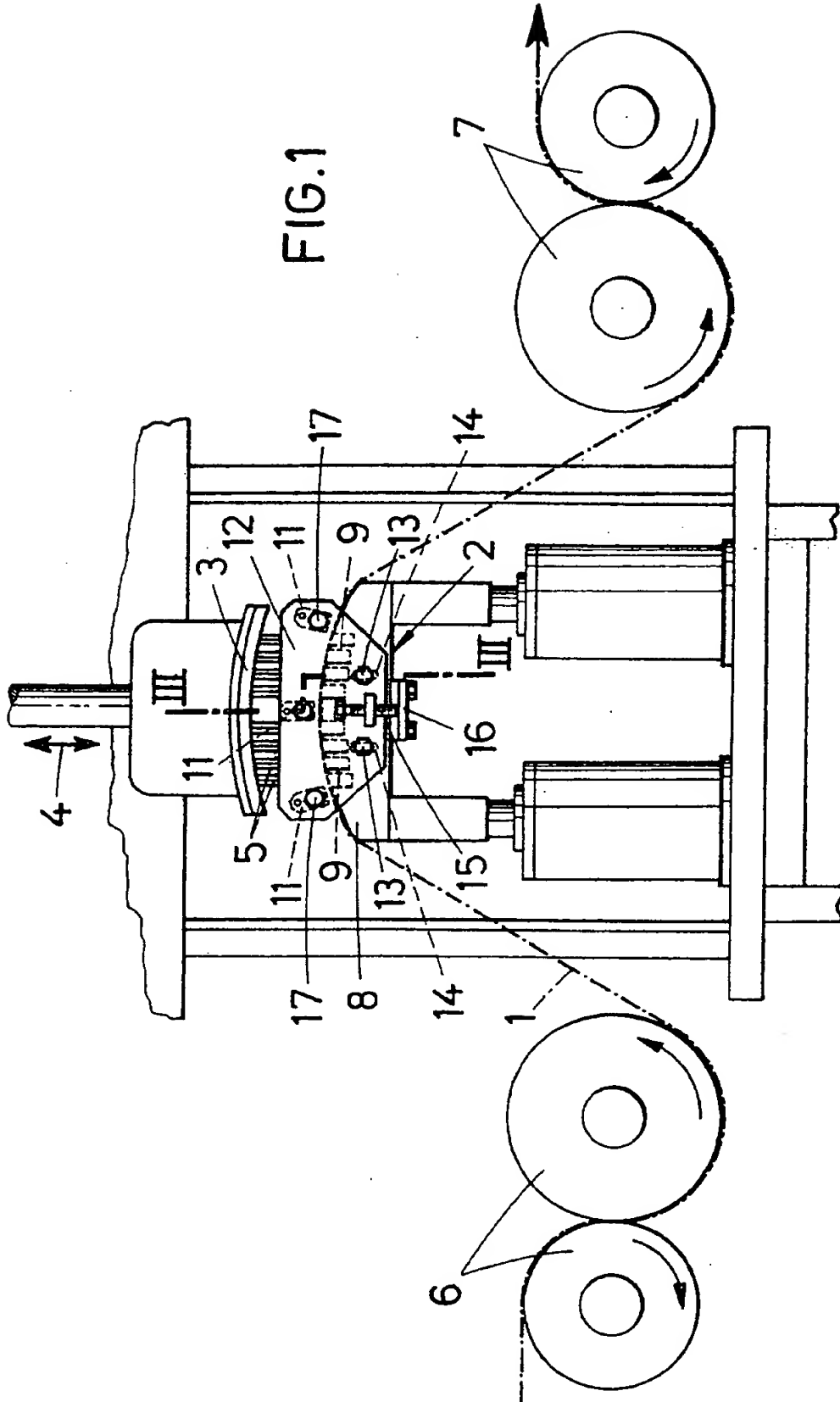


FIG. 2

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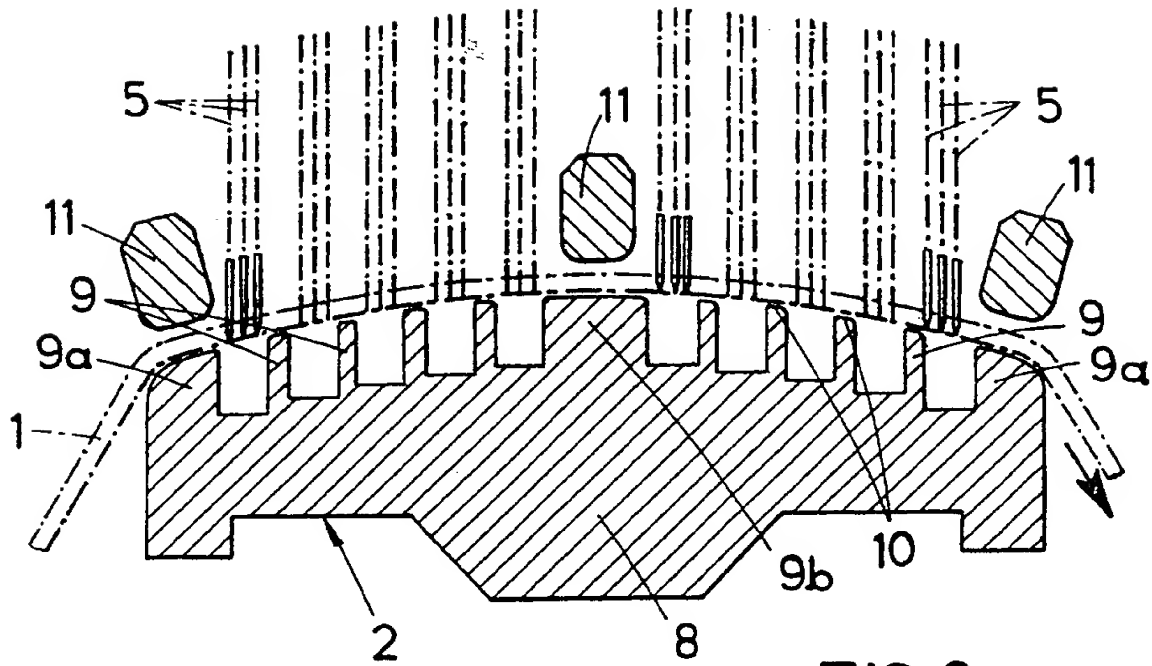


FIG.2

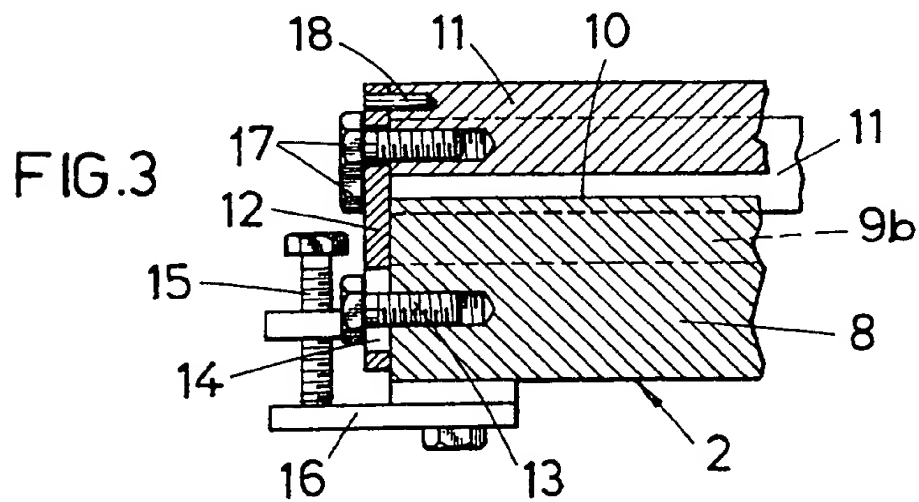
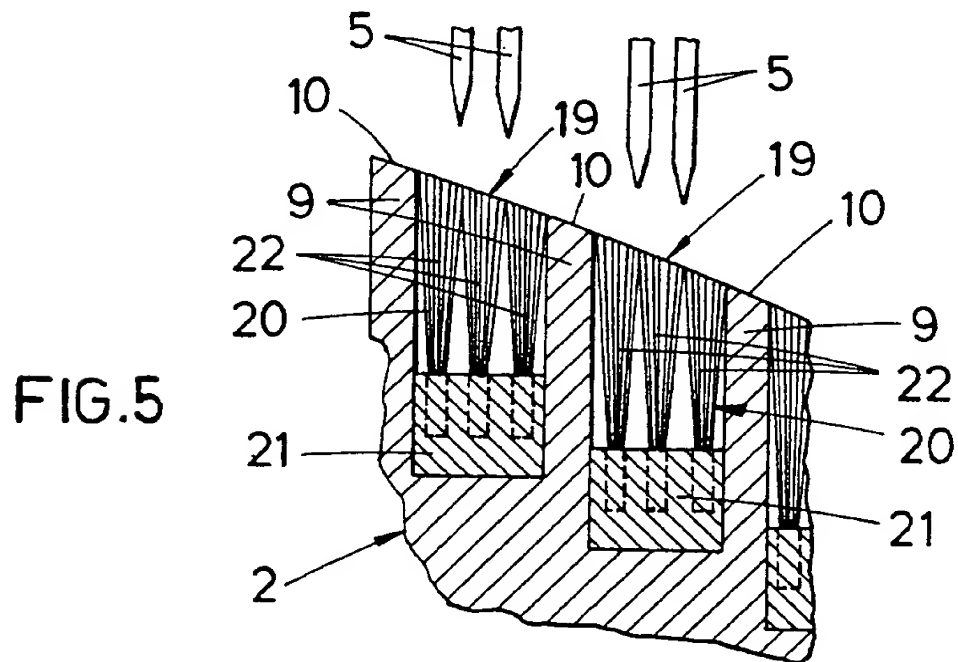
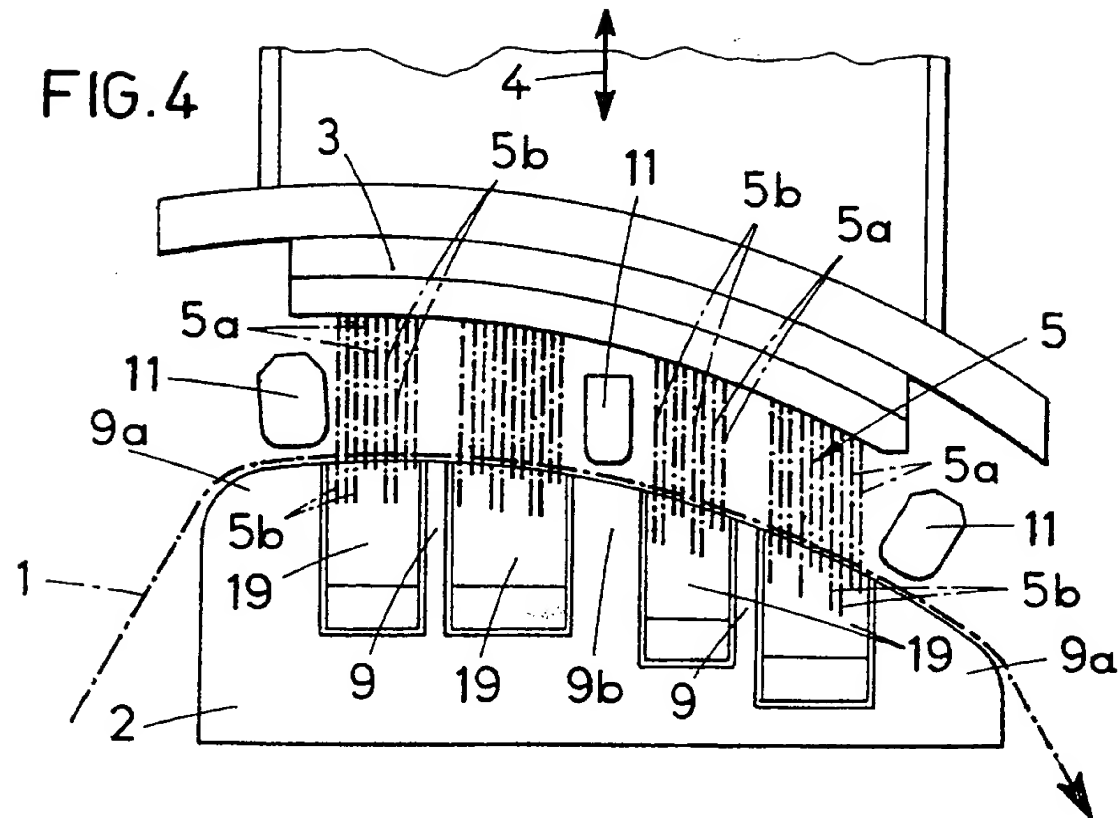


FIG.3



Device for Needling a Prebonded Web

This invention relates to a device for needling a prebonded web, comprising at least one needle board reciprocatingly movable in stitching direction, and comprising a stitch base between a feed roller and a discharge roller, which is located directly opposite the needle board and forming a web guide that is convex in direction of web movement.

In conventional needling devices the web is guided between the stitch base opposite the needle board and a stripper between the stitch base and the needle board, whose needles stitch into the web through holes in the stripper. The stripper, which like the stitch base mostly consists of a perforated plate, has the function of retaining the web with respect to the needles emerging from the web, and of preventing the web from being entrained by the barbs of the needles. A conventional stripper between the stitch base and the needle board can, however, only be omitted when the web is urged against the web support against the withdrawal resistance of the needles. For this purpose, the stitch base may be provided with a curvature that is convex in direction of movement, and the web may be subjected to a corresponding tensile stress, which urges the web against the stitch base in cooperation with the convex support, so that the needles can be withdrawn from the web without having to risk that the web is lifted off the stitch base. The tensile stress acting on the web is easily achieved by means of a corresponding difference of the conveying speeds of the feed roller and the discharge roller. The omission of a stripper, which is possible as a

result of these measures, provides for an increased density of the needle distribution, because the restriction of the mutual needle distance by the distance of the holes in the stripper is omitted, but only when this restriction is not enforced by the stitch base, which should therefore not be designed as conventional perforated plate.

It is therefore the object underlying the invention to improve a device for needling a prebonded web as described above such that despite a higher needle density as a result of the omission of a stripper a sufficient penetration of the needles through the web can be ensured.

This object is solved by the invention in that the stitch base consists of blades extending transverse to the direction of web movement and touching a continuously curved enveloping surface with their end faces constituting a web support, where at least two rows of needles extending transverse to the direction of web movement engage between said blades.

The web drawn over the stitch base under a corresponding tensile stress forms a traverse adapted to the continuously curved enveloping surface, in whose vicinity the web is kept taut, so that the needles can be withdrawn from the web without entraining the web. The web tension between the blades supporting the web in addition facilitates the impingement of the needles, which may be arranged between the blades with a distribution density that merely depends on the strength conditions in the vicinity of the needle board. Since at least two rows of needles extending transverse to the direction of web movement engage between two succeeding blades of the stitch base, a sufficient needle density over the needle area can easily be ensured, so as to obtain a uniform stitch pattern independent of the feed rate of the web during needling, with a high degree of felting.

The blades of the stitch base may be milled out of a plate, which requires, however, a correspondingly convex plate. Simpler manufacturing conditions are obtained when the blades consist of individual webs of graduated height, which due to their graduated height touch a continuously curved enveloping surface. By means of a web height gradually decreasing from the center of the web towards the ends there can in addition be achieved a guidance of the web acting against the width shrinkage resulting from needling.

The edge blades on the side of the inlet and the outlet may advantageously have a larger width than the intermediate blades and constitute a deflection guide for the incoming and outgoing web. The larger width of the edge blades not only serves a higher strength of the stitch base, but also an improved guidance of the web in direction of web movement. The deflection of the incoming and outgoing web at the edge blades in addition ensures a proper abutment of the web at these edge blades, which is an essential condition for a uniform needling.

The tension at which the web is drawn over the convex stitch base necessitates a corresponding pressure with which the web is urged against the blades. Due to the restriction of the applicable tensile load, the resistance to a withdrawal of the needles from the web can, however, lead to the web being locally lifted off the blades, in particular in the middle portion of the stitch base. Therefore, a stripper blade may be associated to at least one middle blade, which stripper blade prevents the web from being lifted off the stitch base, which would impair the needling, without disturbing the distribution density of the needles. To satisfy most needling conditions, a stripper blade may likewise be associated, by way of precaution, not only to the middle blade, but also to at least one of the two edge blades. Particularly advantageous guiding conditions for the web are obtained in this

connection when the blades of the stitch base associated to the stripper blades have a larger width than the remaining blades of the stitch base, which provides for a corresponding design of the stripper blades.

The constructive arrangement of the stripper blades may be chosen differently. To be able to operate with a minimum constructional effort, the stitch base may carry cheeks for supporting the stripper blade(s), which cheeks are vertically adjustable in stitching direction. Separate supports for the stripper are therefore omitted. Nevertheless, the stripper blades may be vertically adjusted with respect to the stitch base via the cheeks for adjusting the guiding gap.

The measure of using needles with mutually offset or graduated working portions in a corresponding distribution over the entire needle area of the needle board advantageously utilizes the fact that the resistance to a withdrawal of the individual needles from the web is different due to the position of their working portion provided with barbs in dependence on the lifting position of the needle board, because as a result of the mutual position of these working portions graduated in groups the same engage in the web with a different number of barbs. For this reason, there can be reduced the withdrawal resistance of all needles engaging in the web, which acts in the sense of lifting the web off the stitch base. The working portions of the one group of needles, which are located closer to the needle board, are withdrawn from the web before the working portions of the other group of needles, so that the number of barbs simultaneously disposed in the web is reduced. The largely uniform distribution of the needles with mutually offset working portions over the entire needle area of the needle board prevents a local agglomeration of needles of uniform working portions and thus a locally increased withdrawal resistance of the needles, which may give rise to a wrong draft of the web.

For utilizing the different withdrawal resistances of the individual needles with respect to the penetration depth of the working portions, it is recommended to adapt the mutual, groupwise offset of the working portions of the needles at least to the thickness of the web to be needled, so that during the withdrawal movement subsequent to the lower return point of the needles the working portions of the one group of needles farther away from the needle board are only moved into the web when the working portions of the other group of needles located closer to the needle board already emerge from the web.

Mutually offset working portions are obtained in the case of needles of equal length for instance as a result of the graduated position of the barbs with respect to the needle tip. Particularly advantageous constructional conditions can be achieved in that the needles with mutually offset working portions have different lengths for each group. The needles of different lengths have the advantage that the friction of the needles outside the working portions can additionally be taken into account.

Due to the arrangement of additional supporting elements between the blades a direct web support in the vicinity of the needle impingements can be ensured, provided that these supporting elements can resiliently evade the needle tips or be pierced by the needle tips with a resilient displacement of material. These supporting elements thus prevent that upon impingement of the needles the web can be drawn into the spaces between the blades while the tensile stress is increased, so that the tensile stresses acting on the web are not only reduced, but there are also created particularly favorable stitching conditions, because the web is supported on the supporting elements directly beside the needle tips against an entrainment by the needles. Despite the supporting elements, the advantage of the stitch base consisting of

blades is not impaired, because the blades still determine the course of the web in direction of web movement.

The supporting elements may consist of brush elements with bristles extending at least substantially in stitching direction. Particularly advantageous needling conditions are obtained when the supporting elements are constituted by a supporting element to be pierced by the needle tips with a resilient displacement of material, where for instance foams or elastomers may be used as supporting elements. By means of such supporting elements there can be achieved a direct support of the web in the vicinity of the needle impingements, so that an additional tensile stress of the web upon impingement of the needles is avoided, namely independent of the distribution density of the needles, which penetrate into the supporting element with a resilient displacement of material. The stitch channels formed with the repeated locally limited impingements represent the respective needle distribution and provide for advantageous ways of guiding the needles in the vicinity of the stitch base.

In the drawing, the subject-matter of the invention is represented by way of example, wherein:

- Fig. 1 represents segments of an inventive device for needling a web in a simplified side view,
- Fig. 2 represents the device in the vicinity of the stitch base in a section in direction of web movement on an enlarged scale,
- Fig. 3 shows a section along line III-III of Fig. 1, likewise on an enlarged scale,
- Fig. 4 represents segments of a modified embodiment of an inventive device in a simplified side view, and
- Fig. 5 represents segments of a different embodiment as compared to Fig. 4 of a stitch base with brush elements

as supporting elements in a section in direction of web movement on an enlarged scale.

The device for needling a prebonded web 1, which is represented in Fig. 1 to 3, substantially consists of a stitch base 2 and a needle board 3 disposed above the stitch base 2, which needle board is reciprocatingly movable transverse to the stitch base 2, as is indicated by the arrow 4. The needles of the needle board 3 are designated with 5. The stitch base 2 has a convex curvature in direction of web movement, where a tensile stress is applied onto the web 1 between a feed roller 6 and a discharge roller 7, which for this purpose is driven at a larger peripheral speed than the feed roller 6.

As shown in Fig. 2, the stitch base 2 consists of a base plate 8 with blades 9 extending transverse to the direction of web movement, which touch a continuously curved enveloping surface with their end faces 10 and constitute a web support. The web 1 is therefore drawn over the blades 9 in the form of a traverse, where the wider edge blades 9a constitute a deflection guide with the effect that due to this deflection the web 1 lies flat against the stitch base 2 both in the inlet area and in the outlet area. As a result of the tensile stress acting on the web 1 between the feed roller 6 and the discharge roller 7 there is produced a pressure urging the web 1 against the blades 9 in connection with the convex stitch base 2, so that the occurring normal forces act against the resistance to a withdrawal of the needles 5 from the web 1. Despite these normal forces, in particular in the case of a high distribution density of the needles 5, which impinge between the individual blades 9 in several needle rows, the web 1 may be lifted off the blades 9 above all in the middle portion of the stitch base 2, which impairs the needling result, in particular when only comparatively small tensile stresses should be applied onto the web 1. For this

reason, a stripper blade 11 is associated to a middle blade 9b, which stripper blade prevents the web 1 from being lifted off the blades 9 and 9b, respectively, in the middle portion of the stitch base 2, which would impair the needling result. Stripper blades 11 may likewise be associated to the edge blades 9a, to ensure a particularly good guidance of the web in the needling area. These stripper blades 11 do, however, not prevent the desired high needle distribution density, because they do not protrude into the needle path of the needle rows between the individual blades 9. The middle blade 9b of the stitch base 2 has a larger width like the edge blades 9a, so that the associated stripper blade 11 can be dimensioned large enough. Moreover, the larger extension of the guiding gap between the stripper blades 11 and the associated blades 9a, 9b of the stitch base 2 involves a better guidance of the web in direction of web movement.

The attachment of the stripper blades 11 can easily be effected by means of cheeks 12, which are mounted vertically adjustable on the lateral end faces of the base plate 8 of the stitch base 2. For this purpose, the fastening screws 13 extend through oblong holes 14 in the cheeks 12, as this can be taken in particular from Fig. 3. The vertical adjustment itself is effected by means of adjusting screws 15, which are supported on a bracket 16 associated to the base plate 8. The stripper blades 11 themselves are fixed between the two lateral cheeks 12 on the end faces by means of screws 17. The fixation of the stripper blades 11 is achieved by means of a locking pin 18.

To improve the web support in the direct area of impingement of the needles 5 into the web 1, there are provided supporting elements 19 between the blades 9, as shown in Fig. 4, which supporting elements bridge the space between the blades 9, 9a and 9b and constitute an additional support for the web 1. These supporting elements 19, which for instance consist

of an elastomer, may be pierced by the tips of the needles 5 with a resilient displacement of material and provide for a very dense needle distribution, so that particularly advantageous needling conditions are obtained, all the more so as the needles 5 penetrating into the web 1 do not effect any additional tensile stresses acting on the web 1. Moreover, the supporting elements 19 contribute to an absorption of vibrations, which leads to a noticeable muffling of noises.

To also reduce the influence of the tensile forces, which are exerted on the web 1 during the withdrawal of the needles 5 from the web 1, on the draft of the web 1, which is in particular important in the case of a high distribution density of the needles 5 because of the then comparatively high total resistance to a withdrawal of the needles 5 from the web 1, there are provided two groups of needles 5a and 5b with working portions mutually offset in stitching direction. For this purpose, the barbs defining the respective working portion might be graduated with respect to each other with the same needle length. In accordance with the embodiment, however, there are provided two groups of needles 5a and 5b with different lengths, where the working portions with the barbs extend directly from the needle tip. The needles 5b are longer than the shorter needles 5a at least by the thickness of the web 1 to be needled. With this measure it is achieved that first the shorter and only then the longer needles 5a and 5b, respectively, are withdrawn from the web 1. Since above all the barbs provided for the entrainment of fibers upon impingement define the withdrawal resistance of the individual needles 5a, 5b, the barbs of the longer needles 5b that have penetrated deeper into the supporting elements 19 through the web 1 can only act on the web 1 when the barbs of the shorter needles 5a have already emerged from the web 1 at least in part. This means that in contrast to needles 5 of equal lengths provided with corresponding working portions the barbs of the shorter and the longer needles 5a and 5b are

withdrawn from the web 1 one after the other, which due to the resulting reduction of the barbs acting on the web 1 at the same time necessarily leads to a reduction of the tensile stress acting on the web 1 in the sense of a lift-off from the stitch base 2. It is, however, necessary that local agglomerations of needles 5a and 5b of uniform length are avoided, so that a largely uniform distribution both of the shorter needles 5a and of the longer needles 5b over the entire needle area of the needle board 3 is required.

Instead of the supporting elements 19, which consist of a material to be pierced by the needle tips with a resilient displacement of material, for instance of an elastomer or a foam, the supporting elements 19 may also be formed of brush elements 20 as shown in Fig. 5, where the bristle clusters 22 inserted in brush carriers 21 form the web support between the blades 9 without impeding the needle impingement, because the individual bristles aligned in stitching direction can laterally evade the tips of the needles 5.

C l a i m s :

1. A device for needling a prebonded web, comprising at least one needle board reciprocatingly movable in stitching direction, and comprising a stitch base between a feed roller and a discharge roller, which is located directly opposite the needle board and forms a web guide that is convex in direction of web movement, characterized in that the stitch base consists of blades extending transverse to the direction of web movement and touching a continuously curved enveloping surface with their end faces forming a web support, which blades engage between the at least two needle rows extending transverse to the direction of web movement.
2. The device as claimed in claim 1, characterized in that the blades consist of individual webs of graduated height.
3. The device as claimed in claim 1 or 2, characterized in that the edge blades on the side of the inlet and on the side of the outlet have a larger width than the intermediate blades and constitute a deflection guide for the incoming and outgoing web.
4. The device as claimed in any of claims 1 to 3, characterized in that to at least a middle blade of the stitch base there is associated a stripper blade between the stitch base and the needle board.
5. The device as claimed in claim 4, characterized in that a stripper blade is associated not only to the middle blade but to at least one of the two edge blades of the stitch base.

6. The device as claimed in claim 4 or 5, characterized in that the stitch base carries cheeks for supporting the stripper blade(s) which cheeks are vertically adjustable in stitching direction.

7. The device as claimed in any of claims 1 to 6, characterized in that the needle board whose needles constitute a working portion provided with barbs for the entrainment of fibers, has at least two groups of needles with working portions mutually offset in stitching direction, and that each group of needles with the same working portion is largely uniformly distributed over the entire needle area of the needle board.

8. The device as claimed in claim 7, characterized in that the mutual groupwise offset of the working portions of the needles at least corresponds to the thickness of the web to be needled.

9. The device as claimed in claim 7 or 8, characterized in that the groups of needles with mutually offset working portions have different lengths.

10. The device as claimed in any of claims 1 to 9, characterized in that the spaces between the blades are bridged by supporting elements for the web to be needled, which supporting elements resiliently evade the tips of the needles and can be pierced by the tips of the needles with a resilient displacement of material.



The Patent Office

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Application No: GB 9718918.7
Claims searched: 1-9

Examiner: Steven McIlroy
Date of search: 21 October 1997

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): D1R (RGFD, RGFX, RGFZ)

Int CI (Ed.6): D04H 18/00

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A, P	GB 2310221 A (Fehrer) See especially figure 6	-
A	GB 1358821 A (Oskar Dilo KG) See especially figures 1 and 2 (3, 7) & lines 54-56, 61-85 on page 2 & 43-56 on page 3	-
A	US 4454637 A (Dilo) See figures 1 and 3 & lines 50-61 in column 3 & 15-30 in column 4	-

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